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EASTERN NUCLEAR SERVICES
SUPPLY SECTION WORK FLOW ANALYSIS

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ABSTRACT

The supply functions of Darlington-NGS and Pickering-NGS have been centralized at an off-site location. Operations Research was requested to provide an objective high-level overview of the work begin done at ENS Supply. The flow diagrams along with the descriptions in this study provide the necessary insight in how ENS Supply is operating. ENS Supply is currently in the state of adjusting to the new organizational structure and changes are being made to improve productivity. Several suggestions for further improvements are made.

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1. INTRODUCTION

The supply functions of Darlington-NGS and Pickering-NGS have been centralized at an off-site location.

The purpose of this report is to provide an objective high-level overview of the work being done at the Supply Section of ENS. Four aspects of this study are documented.

1) *THE INTERVIEWS* - the interviews conducted with the *ENS* management team as well as with supervisors and Material Analysts are briefly described in this section.

2) *THE CURRENT MODEL* - the current business functions of the two major functions (The Site Supply Units and ENS Procurement Units) are described by applying structured systems analysis techniques from the area of data modelling.

4) *ANALYSIS* - differences in handling requisitions for Pickering and Darlington as well as areas of interest are identified and suggestions are made in this section.

2. THE INTERVIEWS

Members of the *ENS* management team as well as supervisors and material analysts were interviewed. Questions asked during the interviews were generally open-ended. The work flow diagrams are inferred from these meetings.

The following are some of the questions and highlights of responses which are generally descriptive and non-work flow related. Sentences in italic are direct quotes.

Q. What is the organizational structure for your unit?

A. For organizational purposes, this is how it is organized (organization charts are provided) *but in reality, there is a great deal of swapping going around. We shall be reviewing the structure in detail and making changes.*

Q. *Do you have quite a few of these task procedures or descriptions?*

A. *Yes, we have quite a few. We have binders for descriptions of various activities that are taking place within the warehouse itself.*

Q. *What kind of interface do you have with your clients* (site supply units)?

A. *The biggest interface I can see is more with the warehouse area. People coming up to the counter wanting to have tools and inventory issued to them. They also have an interface with us via the Material Management System (MMS).*

Q. *What problems do you have in dealing with two separate systems?*

A. *There are no big problems, but there are advantages that we will achieve when we put them together that we are not achieving now. There is no problems other that it is more time-consuming.*

Q. *Is there any difference in terms of the intensity of complaints from Pickering and Darlington? Where do you find most of the complaints coming from?*

A. *Darlington. For every problem or complaint at Pickering, we have 4 or 5 at Darlington. For a number of reasons that are all justified because we are short staffed and are just getting organized. The supply unit was at Brock Road for some time, and Pickering is used to that. At Darlington, we were on site, we were always right there, we had a minimum of 20 people in the supply office for mechanical maintenance and control maintenance. We were dealing with one on one. All the sudden, we were gone. Everyone there was clearly unhappy.* It is interesting to note that the complaints were strong at Pickering but not as strong as Darlington. In terms of processing time, both stations were about the same [1].

3. THE CURRENT MODEL

The current functions of the section are described by adapting structured systems analysis techniques. The current logical model (with minor modifications) will provide an objective overview of the ENS Supply Section.

The level of descriptive detail corresponds to the level of the diagram. The first level contains general descriptions and the lower levels are more detailed. Where required, the lowest processes are further described. Relationships between the processes are illustrated in *Figure 1 - Tree of Process Relationships*. APPENDICES 2, 3 comment on and/or indicate the relative efforts going into the processes and inputs.

3.1 Supply Section

Figure 2 - ENS FLOW LEVEL 0 illustrates ENS Supply as one process while the four major

interfacing blocks as external entities. ENS Supply interfaces to three *Hydro* internal groups and one external group. The client at Pickering and Darlington Nuclear Generating Stations, the purchasing group at Supply Division, and the systems group at Information Services Division constitute the internal contacts, while the various vendors that supply the material and/or services comprise the external group.

ISRs originate from the client, either manually or through the Material Management System (MMS). *Purchase Requisitions* are created and sent to the buyers of Supply Division. Packing slips and invoices, along with the ordered material, are sent to ENS Supply; *ENS* Supply then in turn issues the material or provides the service to the client.

The Supply Section is responsible for the procurement and supply of material and services for Pickering and Darlington Nuclear Generating Stations, as well as for the Eastern Nuclear Training Center (ENTC). Specifications for updating *MMS* is also the responsibility of the Supply Section.

Figure 3 - ENS Supply Function Level 1 depicts two major functions within the Supply Section. The identified data flow interfaces to the Procurement Unit.

3.2 Procurement Units

There are three units in *Procurement*. The *Projects Unit* conducts special planning studies and provides a liaison for projects. The *Systems Unit* is responsible for the preparation of specifications and training for the *MMS* system, as well as for conducting procedural studies. The *Material and Services Unit* processes *ISRs* for material, service or contract acquisition, as well as participates in inventory control. *Figure 4 - Procurement Function Level 1.1* identifies the 6 major functions of procurement.

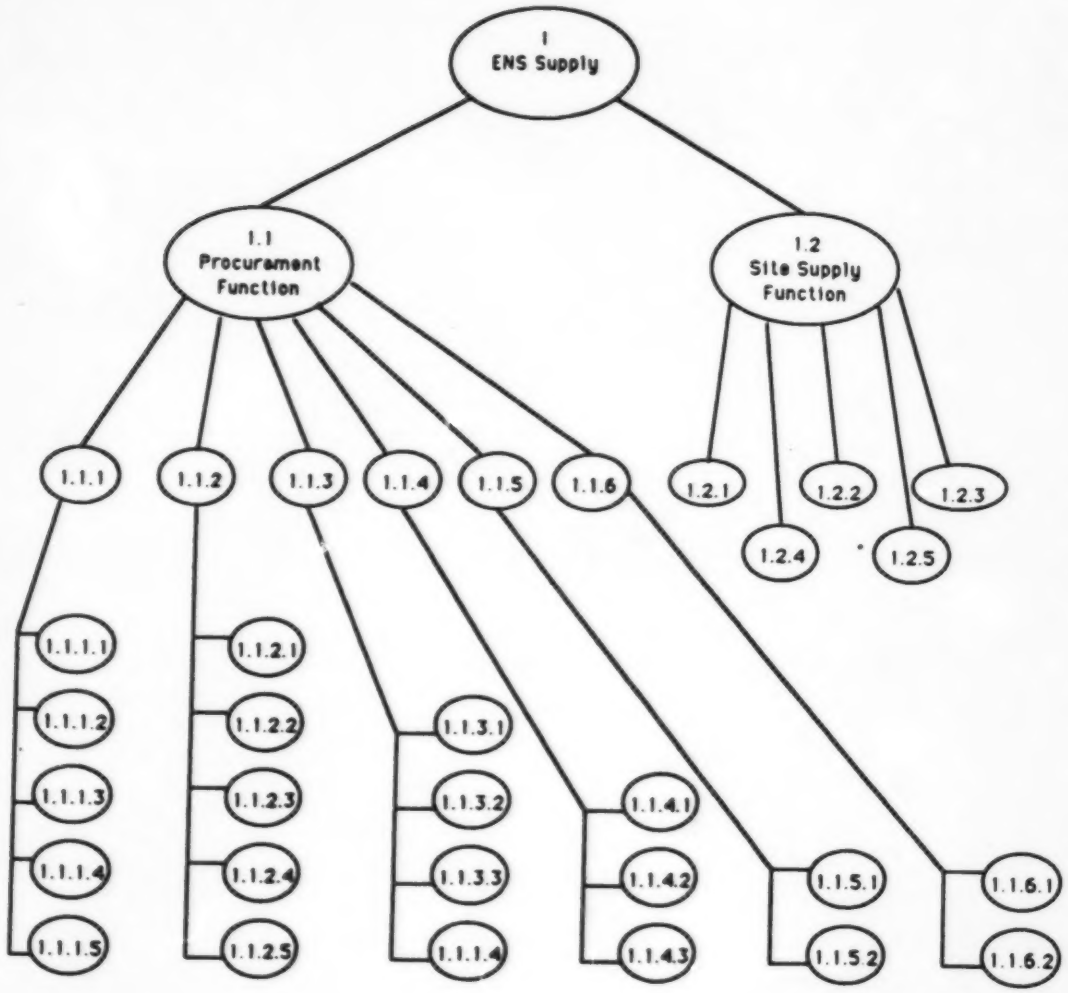
Figure 5 - Process ISRs/Contracts Level 1.1.1 depicts the work flow for processing *ISRs* and contracts. Currently, 60-70% of the *ISRs* are electronic. Each material Analyst handles about 30 ISRs per week. Quality Assurance (QA) related *ISRs* is approximately 25%.

The electronic *ISRs* are computerized as far as the station inputing their requirements. They are electronically routed to the *MAs*. The *MAs* electronically review it and indicate whether it needs special storage handling, better description or otherwise. From there, they electronically route it to the Supply System Clerk. The clerks would set up the requisition manually at this point.

Note that contracts are initiated as an ordinary, not an electronic *ISR*. They are classified as contracts and examined by the material analysts and are sent to the clerks for processing. Contracts are used to perform a service or require a material on an on-going basis over a period of time or up to a certain dollar value. So rather than have to initiate an ISR everytime they want a service or product, contracts are released. Currently, there are 172 on-going contracts for both stations and 128 one-time contracts for Darlington.

The processes involved in upgrading *MMS* are illustrated in *Figure 6 - System Update Level 1.1.2*.

TREE OF DFD PROCESSES



1.1.1 Process ISRs/Contracts
1.1.2 System Update
1.1.3 Work Packages
1.1.4 Accounting/Receipting
1.1.5 Revisions
1.1.6 Quarantines/Expediting

1.1.1.1 Direct ISRs to Specific MAs
1.1.1.2 MAs Check for Technical Details on Requisition
1.1.1.3 Supply Systems Clerks Process ISRs
1.1.1.4 Clerk Typists Type Requisition
1.1.1.5 Process Contract

1.1.2.1 Perform Initial Test on Testing Environment
1.1.2.2 Perform Acceptance Testing
1.1.2.3 Prepare Specifications
1.1.2.4 Prepare Cost/benefit Package
1.1.2.5 Authorise Package

1.1.3.1 Act on Demand for Bill of Materials
1.1.3.2 Acquire Material from Inventory
1.1.3.3 Order Additional Material
1.1.3.4 Order New Material

1.1.4.1 APAYS Clerk
1.1.4.2 Accrual Accounting/Unreconciled Receipts
1.1.4.3 Accrual Accounting/Journal Postings

1.1.5.1 MAs Review Hardcopy
1.1.5.2 Supply Clerk Performs Changes in MHS

1.1.6.1 Quarantine Clerk
1.1.6.2 Expediting Clerk

1.2.1 Stockkeeper Perform Inventory Count
1.2.2 Supply Clerk Perform Inventory Reconciliation
1.2.3 Receiving Unit
1.2.4 Stockkeeping
1.2.5 Counter Service
1.2.6 Warehouse Office

Figure 1 - Tree of Process Relationships. Relationships between the processes are illustrated in this figure.

Figure 7 - Work Packages Level 1.1.3 identifies the steps for processing work packages. A work package is a bill of materials [2] set up by the field work management team identifying work to be done and they usually indicate the material that is required for the job. The initial demands are prepared in the *Work Management System*. The final demand appears in the *Material Management System*.

Figure 8 - Accounting/receipting Level 1.1.4 illustrates accrual account and APAYS work flows. Accrual accounting is set up to settle cost discrepancies while APAYS is originated from the head office to resolve invoices which have not been paid. Currently, the number of APAYS accumulated for Pickering is about 18,000 (2,000 in 1990).

The processes for stock code revisions, quarantines and expediting can be found from *Figure 9 - Revisions Level 1.1.5* and *Figure 10 - Quarantines/expediting Level 1.1.6*, respectively.

3.3 Site Supply Units

There are five major functions identified in the Site Supply Units. *Figure 11 - Site Supply Function Level 1.2* illustrates these functions and data flow between them.

Processes 1.2.1 and 1.2.2 account for one function. Inventory counts are performed by the stock-keepers. The inventory report is first created from the MMS system and then it is routed to the shift that does the physical count. The result of inventory count is sent to the clerk. If there are any discrepancies, the clerk asks the stock-keepers to do a recount.

Warehouse operations for both Pickering and Darlington are very similar. The only noticeable difference is the tool cribs management. Darlington implemented a bar-coded computer system whereas Pickering uses a manual system.

4. ANALYSIS

ENS Supply is currently in the state of adjusting to the new organizational structure. A significant number of employees are handling tasks that they have not encountered when they worked for one station. A fair amount of training is being done, and changes are continually being made, based on feedback among the supervisors and their staff.

4.1 Darlington and Pickering Differences

This section describes the allocation of human resources and differences between the work being done for Darlington and Pickering.

4.1.1 Manpower Allocation

Differences in staff allocation can be found from *TABLE 1*. The differences in quantity are mainly due to Pickering being a fully operating station whereas Darlington is not.

TABLE 1 - SITE SUPPLY MANPOWER ALLOCATION

FUNCTION	DARLINGTON	PICKERING
Supervisory*	10	12
Material Analysis	1	1
Specialists	1	1
Clerical	3	3
Stockkeeping	29	35
Handyperson	0	3
TOTAL	44	55

TABLE 2 indicates the number of employees assigned to the major functions. In terms of staff quota for contracts, one supervisor, one specialist and four clerks are dedicated to processing the contracts. In addition to the contract team, *Material Analysts* are involved in examining contract requisitions.

TABLE 2 - MATERIAL AND SERVICES UNIT MANPOWER ALLOCATION

FUNCTION	QUANTITY
Supervisory**	6
Material Analysis	8
Specialist	4
Clerical	26
TOTAL	44

4.1.2 System Differences

Two copies of the *MMS (Material Management System)* are running at PNGS and DNGS.

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* The supervisory numbers include union supervisory positions, 6 at DNGS and 8 at PNGS, 5 at each site are shift supervisors.

** Including 1 non-supervisory OSS on project assignment.

Although they perform the same functions, they are not compatible with each other since some of the data structures are different. There are not many problems other than it is more time-consuming in the testing phase to verify the different structures and that the communication utilities are not fully utilized (eg. checking users' schedule on PROFS who have their machine connected to the other host).

4.1.3 Buyer Enquiries

The practices being used by the *Material Analysts (MAs)* for resolving buyer enquiries are different for Darlington and Pickering. *TABLE 3* lists the differences. The MAs generally feel that it is more efficient to have one group of contacts instead of two groups in resolving buyer enquiries.

One fact that is worth focusing on is that the MAs spend about 35% of their time on buyer enquiries and only about 5% on reviewing ISRs.

TABLE 3 - DIFFERENCES IN RESOLVING BUYER ENQUIRIES

PICKERING	DARLINGTON
Contact 1 or 2 design engineers at the head office.	Contact system engineers on site. Site engineers normally consult design engineers at head office.
Consistent and better contact.	Not as efficient.
Also implemented for Bruce.	Although it takes some of the workloads of the MAs.

4.2 The Material Analysts

The MAs in procurement are involved in the critical functions of ENS Supply. Their job duties range from reviewing ISRs to handling buyer enquiries and from setting inventory reorder points/quantities to expediting. They also review the stock code revisions, plan outage material and process departmental transfers. TABLE 4 summarizes the functions identified.

As mentioned in section 4.1.3, the *MAs* spend a significant amount of their time resolving buyer enquiries -they spend about 35% of their time on it. When the *ISRs* do go back to the *MAs*, they are regarding buyer enquiries.

Besides screening *ISRs* and handling buyer enquiries, the *MAs* work on the other functions such as setting reorder points in conjunction with the auto-reorder process.

Currently, there are 3 material analysts (including the Supply Office Supervisor) whose technical background is in either mechanical technology or the material sciences. The others are trained in the nontechnical areas. Some of the supervisors indicated that the material analysts who do not have sufficient technical experiences would perceive and process what came across the materials unit but not necessary know the implications of the practice. This implies that a great deal of monitoring and training is required.

TABLE 4. MATERIAL ANALYST RESPONSIBILITIES

ITEM	TIME	FUNCTION	COMMENT
1	12%	ISRs	Review ISRs, contracts, labour requirements, Nuclear Class requirements and QA requirements
2	13%	ROP/ROQs, Auto-reorders	Set reorder quantity/point in conjuction with warehouse
3	35%	Buyer Enquiries	Resolve buyer enquiries
4	10%	Stock Code Revisions	Review stock code revisions
5	3%	Outage Material Planning	Plan outage material, eg. Darlington
6	2%	Departmental Transfers	Material tranfer between departments
7	5%	Expediting	Expediting with clerk
8	20%	Station/Supplier Communication	Expediting with clerk

4.3 Suggestions

1) Since the *MAs* have a heavy workload [section 4.2], it is recommended that part of their work that does not require much technical knowledge be distributed to the clerks, and, if possible, hire additional *MAs*.

2) Since the intensity of complaints are much higher at Darlington than at Pickering [section 2], more staff should be allocated to Darlington.

3) Implement centralized computer system at one location [section 4.1.2].

4) Electronic *ISRs* are automated up to the point where the clerks receive the electronic *ISRs* [section 3.1], it is recommended that the electronic *ISRs* be further automated down to the actual requisition (buyer) level.

5) Implement Pickering method in handling buyer enquiries [section 4.1.3].

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1. Goushleff, D.C., *ENS Performance Measures*. Toronto, Ontario: Ontario Hydro Research Division Report, 1990.

2. Brown, R.G., *Decision Rules for Inventory Management*. New York, N.Y. Holt, Rinehart and Winston, 1967.

APPENDIX 1 - WORK FLOW DIAGRAMS

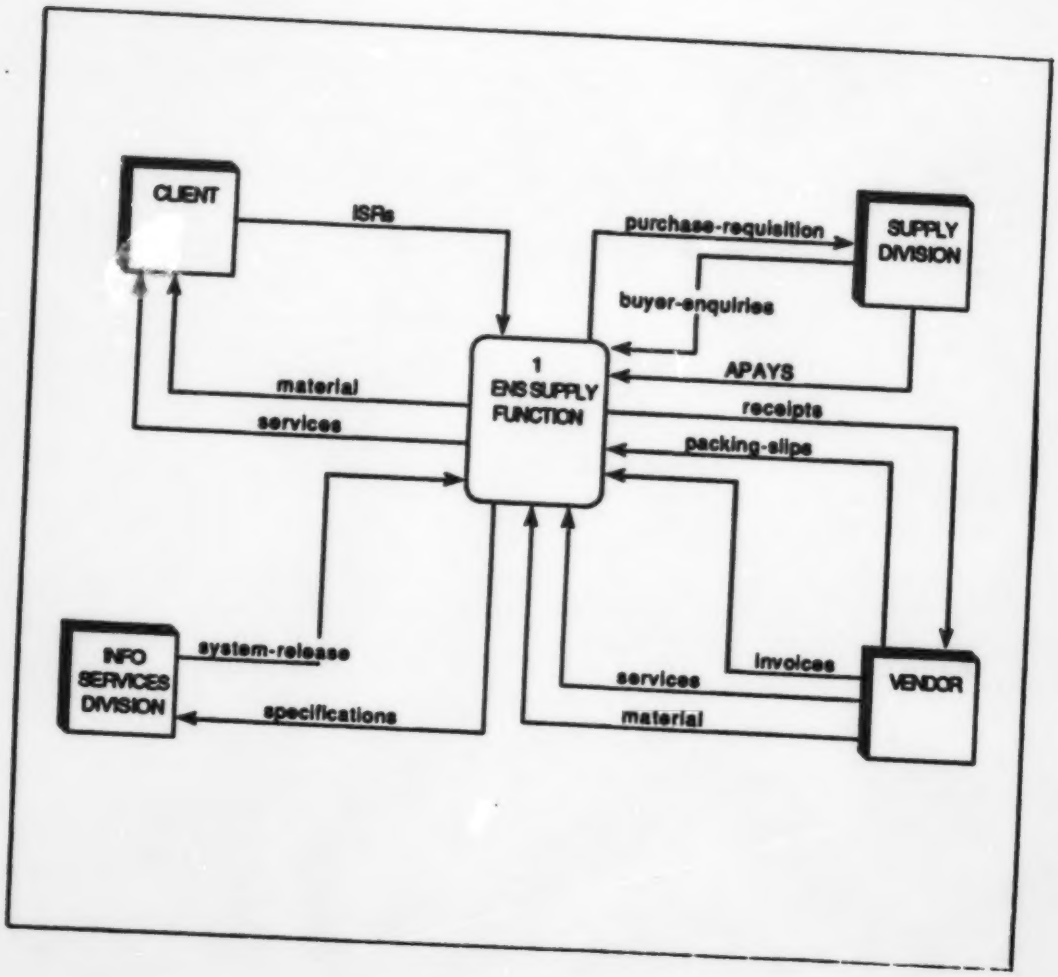

Figure 2 - ENS FLOW LEVEL 0. This figure illustrates ENS Supply as one process while the four blocks that it interfaces to as external entities.

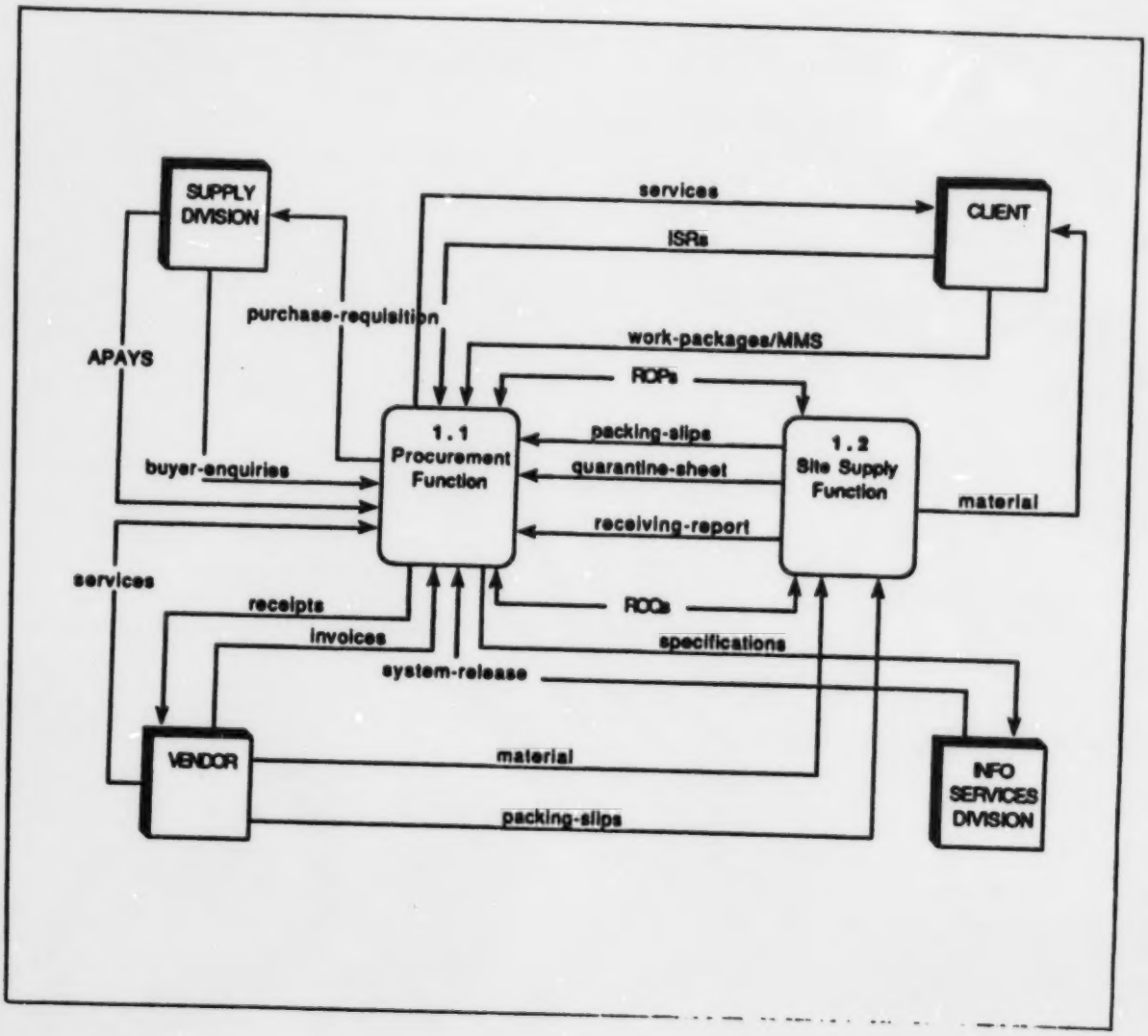

Figure 3 - ENS Supply Function Level 1. This figure depicts two major functions within the Supply Section. The identified data flow interfaces to the Procurement Unit.

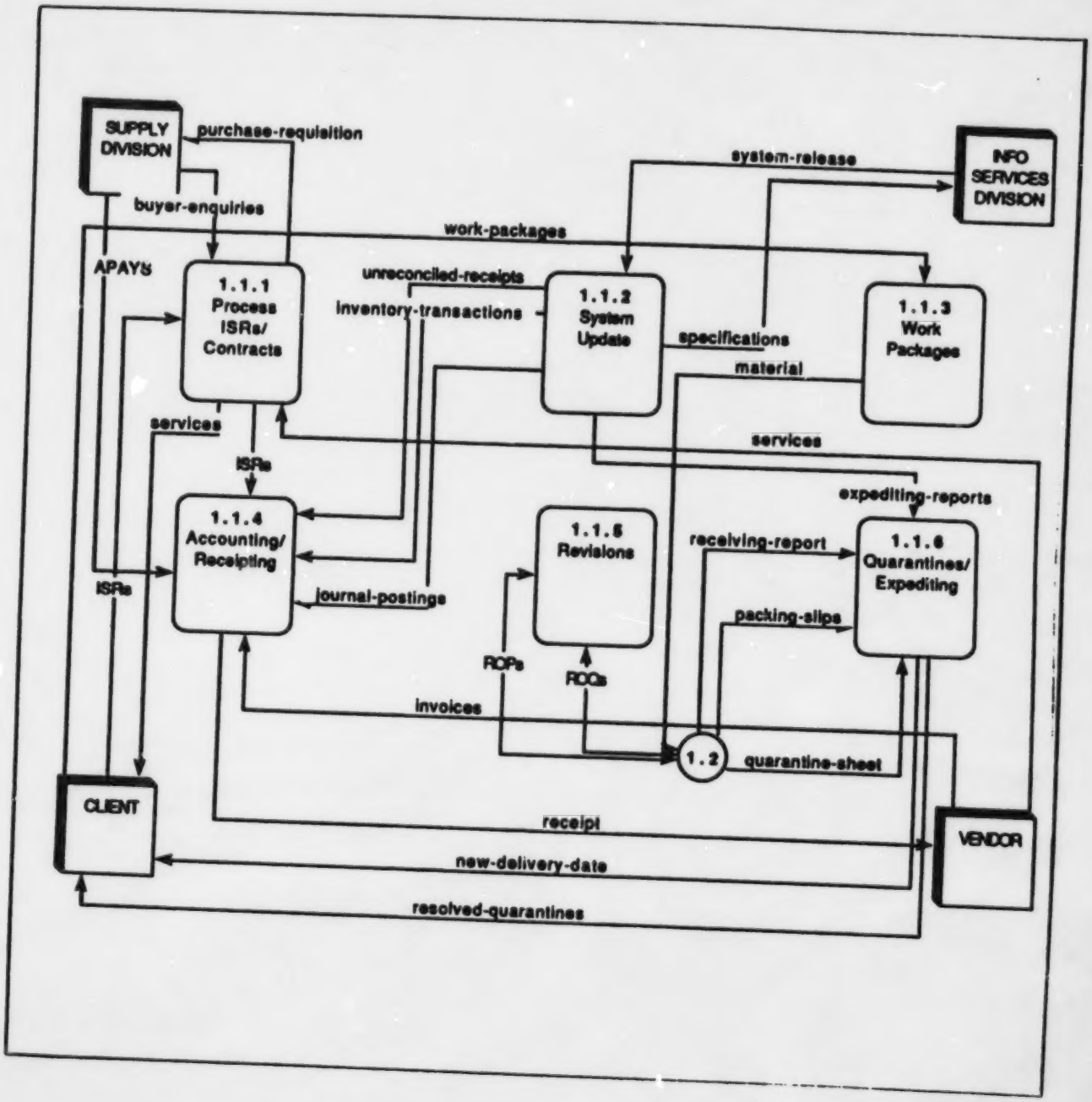

Figure 4 - Procurement Function Level 1.1. This illustration identifies the 6 major functions of procurement.

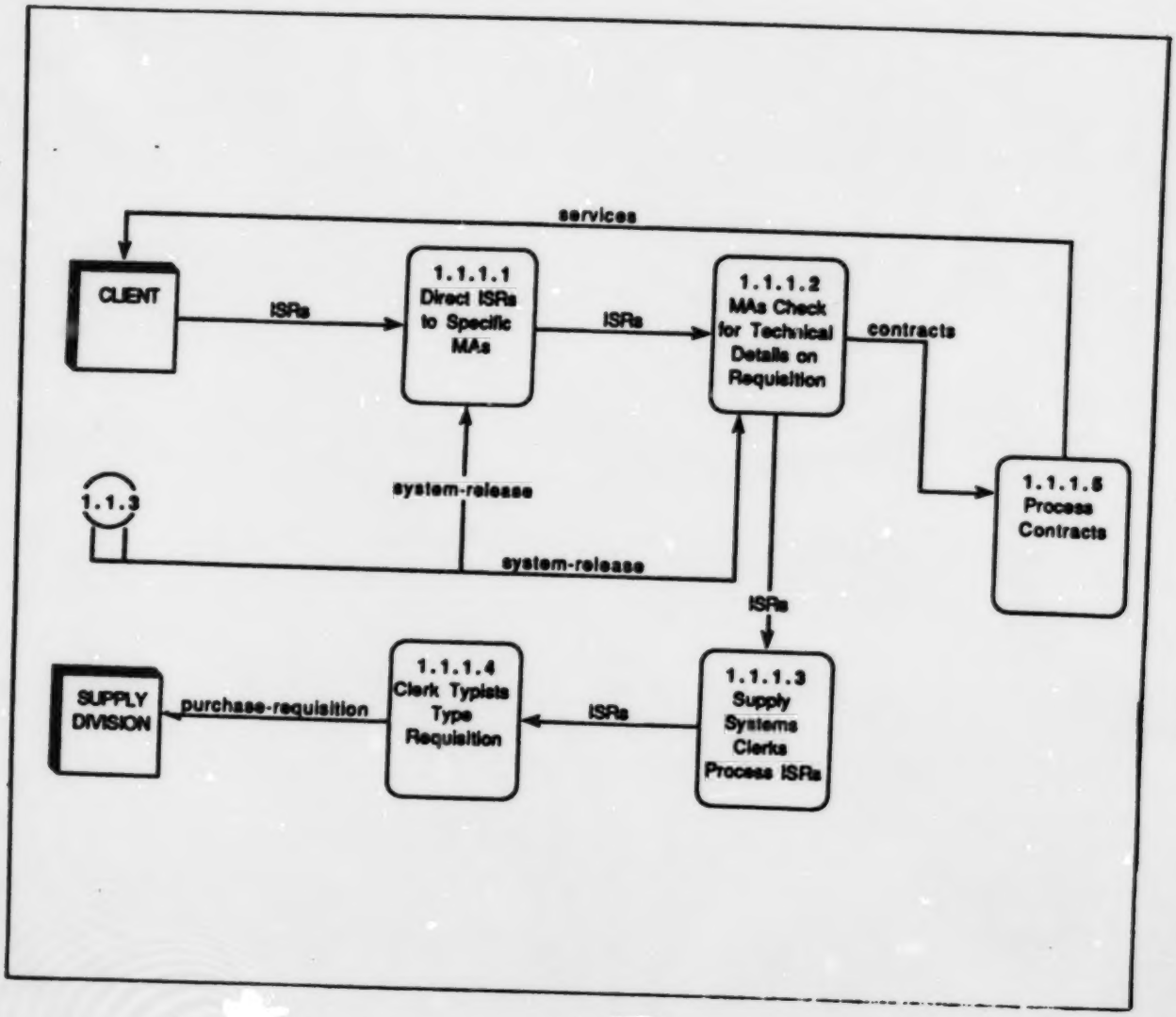

Figure 5 - Process ISRs/Contracts Level 1.1.1. This figure depicts the work flow for processing *ISRs* and contracts.

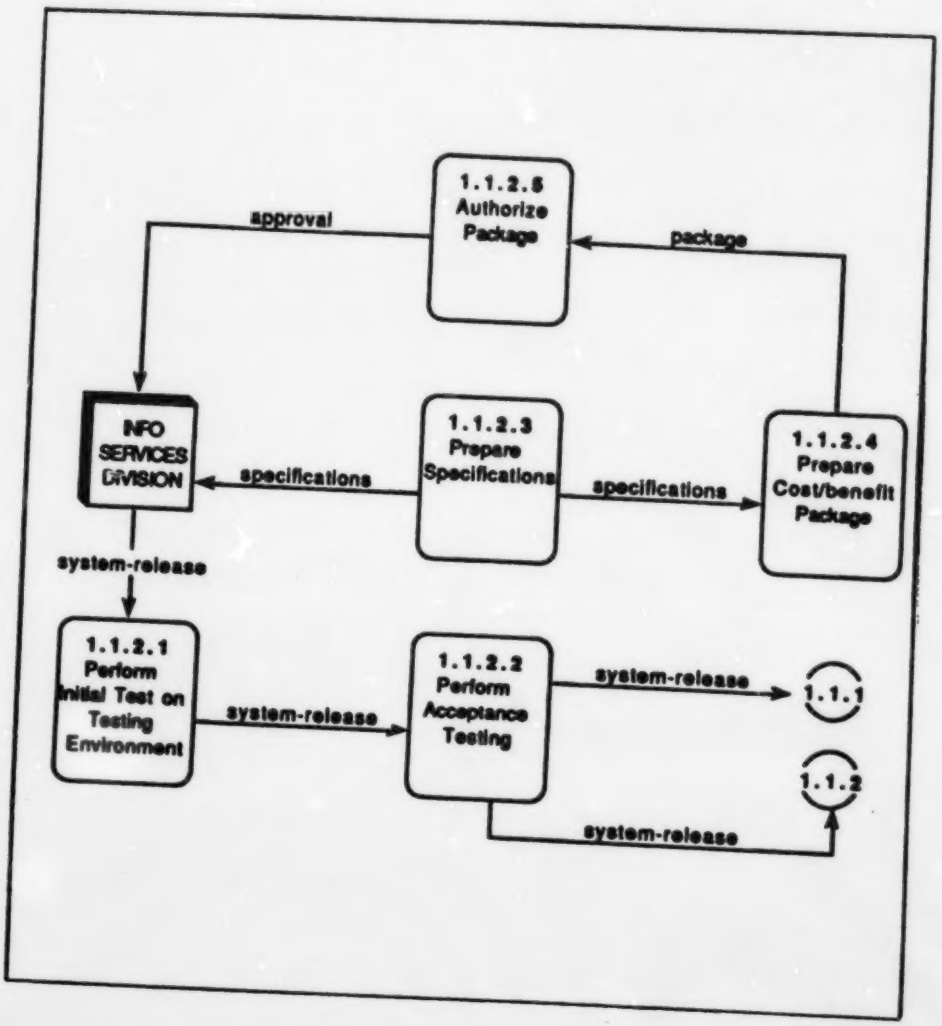

Figure 6 - System Update Level 1.1.2. The processes involved in upgrading are illustrated in this figure.

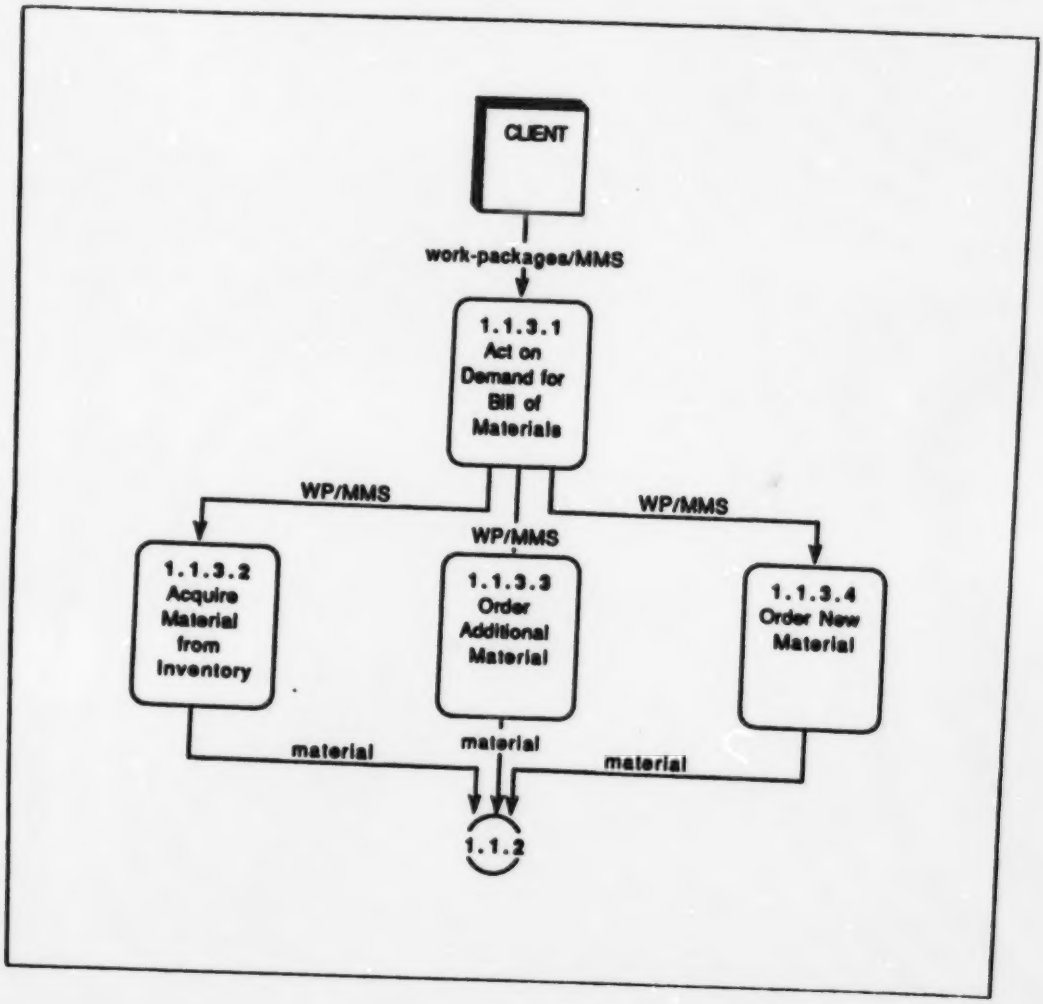

Figure 7 - Work Packages Level 1.1.3. This figure identifies the steps for processing work packages.

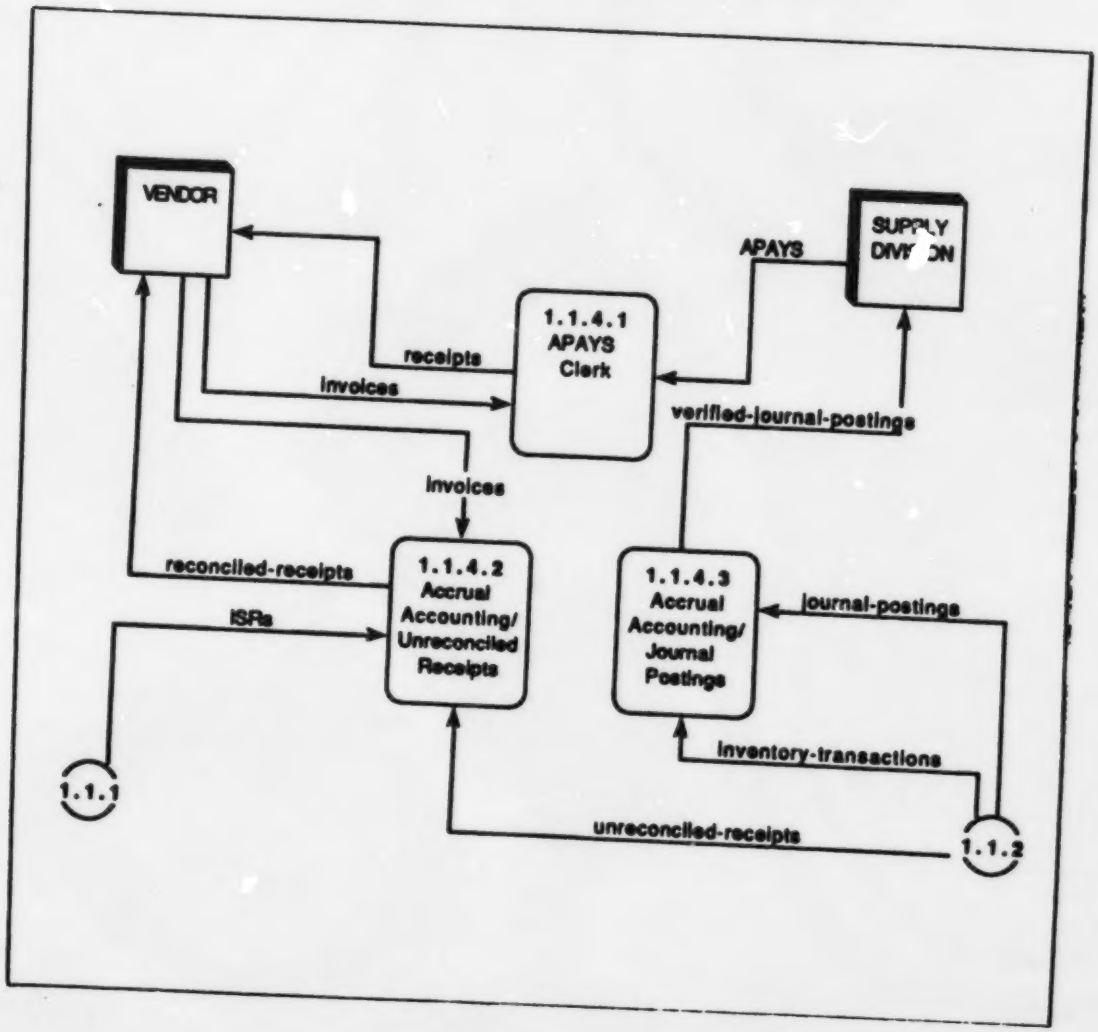

Figure 8 - Accounting/receipting Level 1.1.4. This figure illustrates accrual account and APAYS work flows.

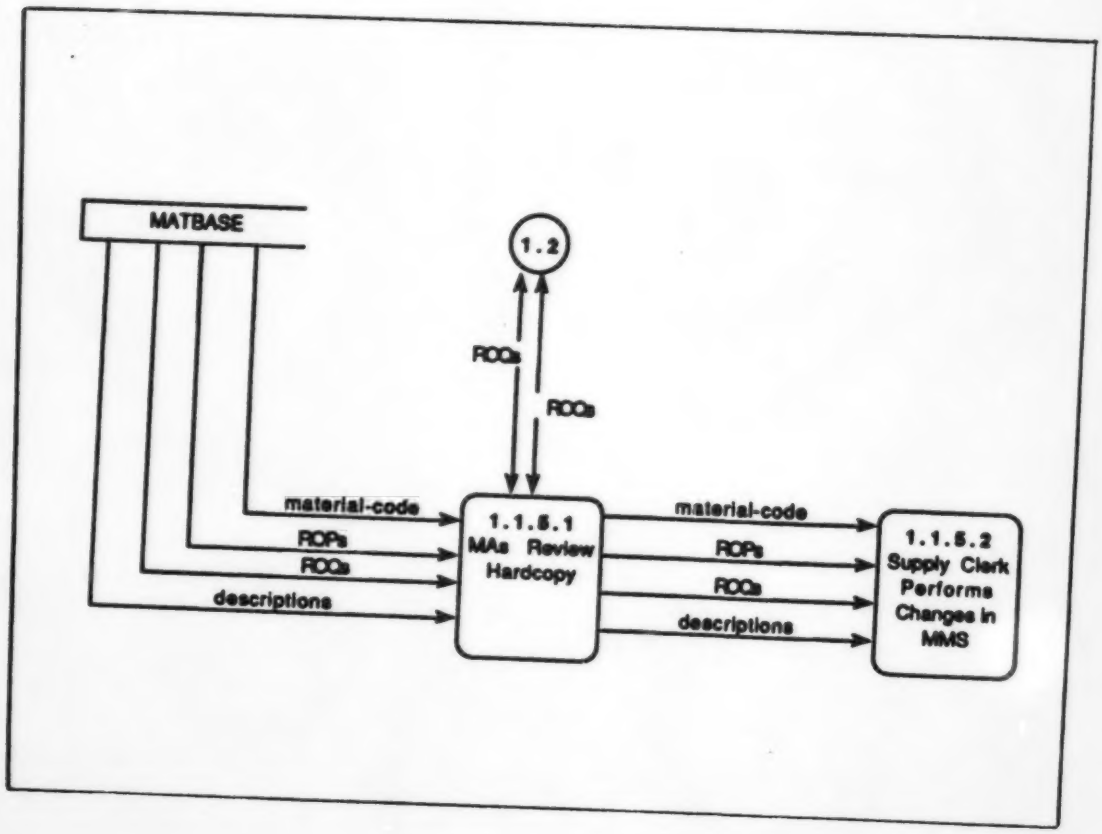

Figure 9 - Revisions Level 1.1.5. The processes for stock code revisions are depicted in this figure.

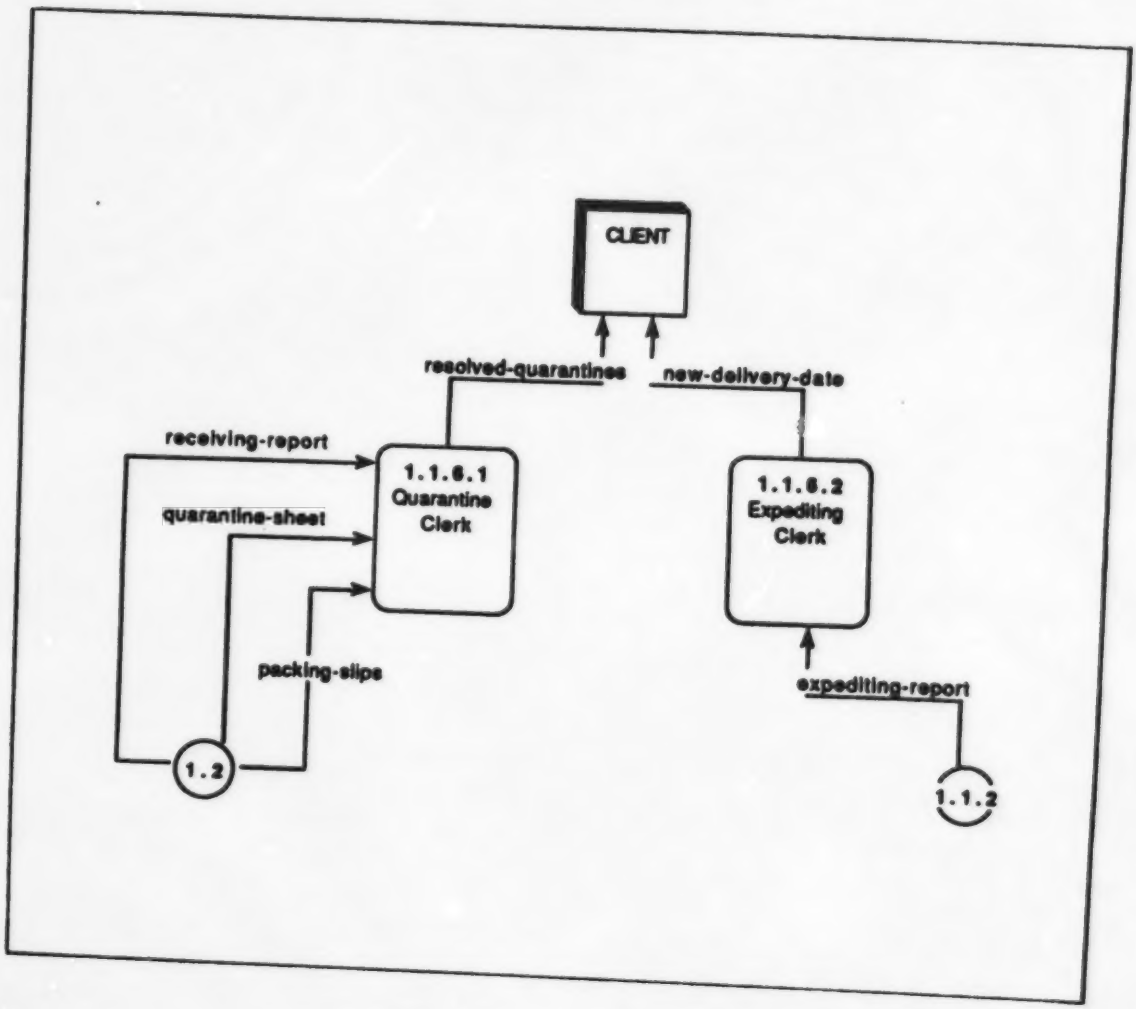

Figure 10 - Quarantines/expediting Level 1.1.6. Quarantines and expediting can be found in this figure.

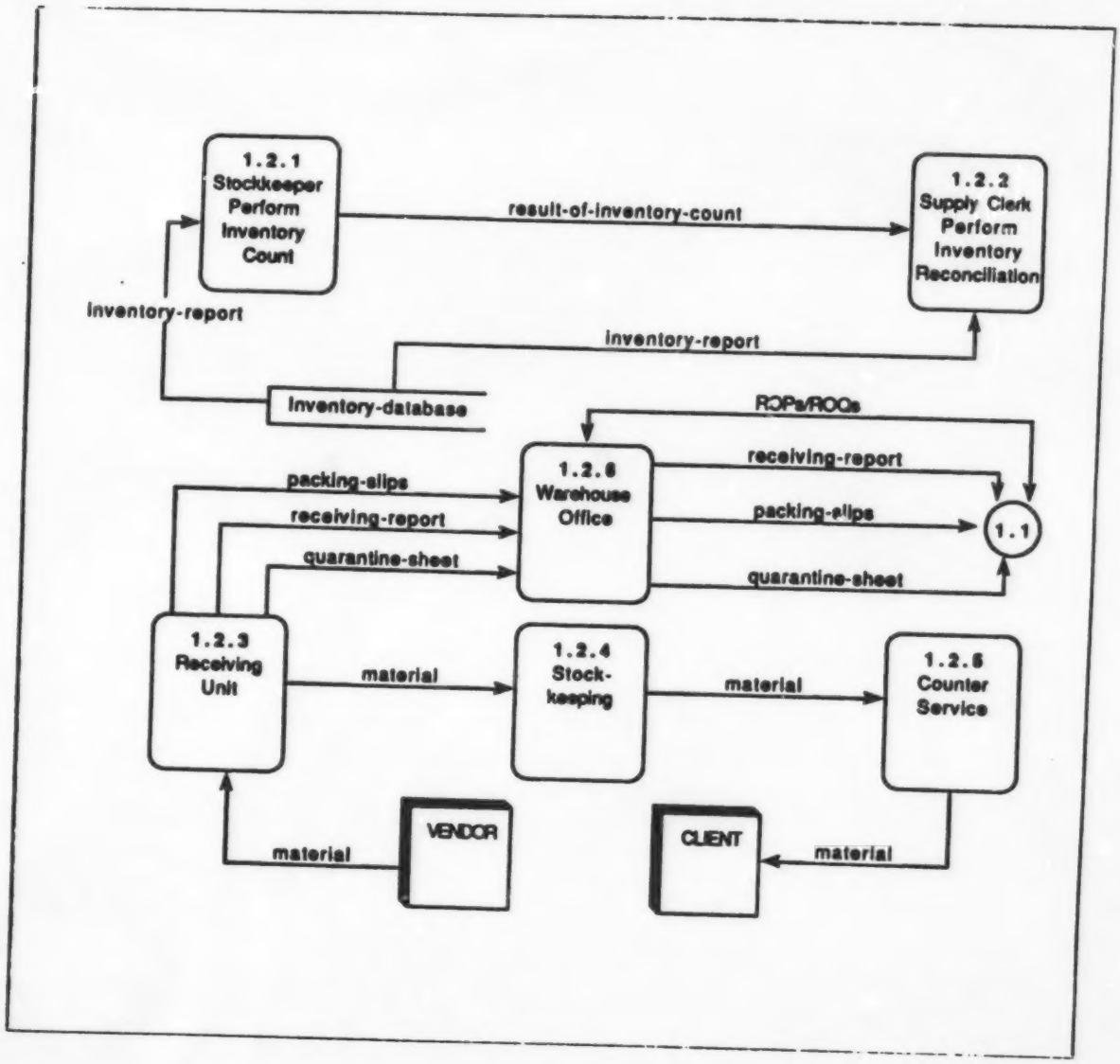

Figure 11 - Site Supply Function Level 1.2. This figure illustrates these functions and data flow between them.

APPENDIX 2 - LIST OF PROCESSES

LIST OF PROCESSES

LEVEL	PROCESS DESCRIPTION	RELATIVE EFFORT/COMMENTS
1.1	Procurement Function	About 27% of ENS Supply Staff Is Committed to this Function
1.2	Site Supply Function	About 65% of ENS Supply Staff Is Committed to this Function
1.1.1	Process ISRs/Contracts	Both the MA's and Supply Clerks Are Involved
1.1.2	System Update	Only About 3% of ENS Staff Is Working on MMS Updates
1.1.3	Work Packages	Bill of Materials Appears on MMS as Work Packages
1.1.4	Accounting/Receipting	APAYS and Accrual Accounting
1.1.5	Revisions	An Entry Level Clerical Function
1.1.6	Quarantines/Expediting	Two Entry Clerical Staff Are Working on these Two
1.1.1.1	Direct ISRs to Specific MAs	ISR's Are Directed to the MA's Either Electronically or Manually
1.1.1.2	MA Check for Technical Details	MA's Spend About 12% of Their Time on Requisitions
1.1.1.3	Supply Systems Clerks Process ISRs	Supply Systems Clerks Process and Direct the ISR's to Buyers
1.1.1.4	Clerk Typists Type Requisition	Clerk Typists Prepare Requisition
1.1.1.5	Process Contract	Clerks Process and Maintain Contract
1.1.2.1	Perform Initial Test on Testing Envirm.	The Systems Unit Perform Testing Normally During After Hours
1.1.2.2	Perform Acceptance Testing	Perform Acceptance Testing
1.1.2.3	Prepare Specifications	Specifications Are Prepared by the Systems Unit
1.1.2.4	Prepare Cost/benefit Package	Cost/benefit Package for the Specifications Are Written
1.1.2.5	Authorize Package	Approval is Required for The Cost/benefit Package
1.1.3.1	Act on Demand for Bill of Materials	Order Material for Bill of Materials
1.1.3.2	Acquire Material from Inventory	Acquire Material from Inventory if Available
1.1.3.3	Order Additional Material	Order Additional Material if Out of Stock
1.1.3.4	Order New Material	Order New Material if Required
1.1.4.1	APAYS Clerk	An Entry Level Clerical Function
1.1.4.2	Accrual Accounting/Unreconciled Recpts.	Unreconciled Receipts, Normally by the Same Clerk as Next Row
1.1.4.3	Accrual Accounting/Journal Postings	Journal Postings, Normally by the Same Clerk as Previous Row
1.1.5.1	MAs Review Hardcopy	MAs Review Hardcopies of Changes
1.1.5.2	Supply Clerk Performs Changes in MMS	Supply Clerk Performs Changes in MMS After the MA's Review
1.1.6.1	Quarantine Clerk	An Entry Level Clerical Function
1.1.6.2	Expediting Clerk	An Entry Level Clerical Function
1.2.1	Stockkeeper Perform Inventory Count	Stockkeeper(s) Perform Inventory Count
1.2.2	Supply Clerk Perform Inventory Recncln.	An Supply Clerk Perform Inventory Reconciliation
1.2.3	Receiving Unit	The Receiving Unit Unloads Material
1.2.4	Stockkeeping	Stockkeeping Stores Material
1.2.5	Counter Service	Materials Are Issued at the Counter
1.2.5	Warehouse Office	About 3 to 5 Staff in Each of the Two The Supply Office

APPENDIX 3 - LIST OF FLOWS

LIST OF FLOWS

INPUT TO PROCESSES	RELATIVE EFFORT/COMMENTS
APAYS	APAYS Which Is A System Originated from the Head Office
approval	Approval for Cost/Benefit Packages of MMS Specifications
buyer-enquiries	The MA's Spend About 35% of Their Time on Buyer Enquiries
contracts	Normally Service Contracts, Either One-time or Long-term
descriptions	Review by the MAs and Change by the Clerks
expediting-reports	Expediting Reports the Clerk Responsible
inventory-report	Inventory Report for Inventory Count
inventory-transactions	Inventory Transactions to be Used For Accrual Accounting and Receipting
invoices	Invoices from the Vendor
ISRs	Internal Supply Requisitions in Electronic or Paper Form
journal postings	Journal Postings for Head Office
material	Materials to Be Issued or Ordered
material-code	Material Code Used in the Warehouses
new-delivery-date	New Delivery Date Promised by Vendor - Effort of Expediting Clerk
package	Cost/benefit Package for MMS Specifications
packing-slips	Packing Slips are Required for Invoicing
purchase-requisition	Purchase Requisition Send to the Buyers
quarantine-sheet	Used by the Qurantine Clerk to Perform Her Duties
receipts	Vendors Need Receipts in Order to Get Credit From Ontario Hydro
receiving-report	Receiving Report Are Used by the Quarantine Clerk
reconciled-receipts	Receipts Finally Send to the Vendor
ROPs, ROQs	Reorder Points, Reorder Quantities
resolved-quarantines	Resolved Quarantines
result-of-inventory-count	Result of Inventory Count to Be Reconciled by Clerk
services	Services Provided to the Client by the Vendors Through ENS Supply
system-release	New Release of MMS
specifications	Specifications of MMS, Usually Updates
unreconciled-receipts	Receipts Not Send to Vendor
verified-journal-postings	Verified Journal Postings
work-packages/MMS	Work Packages Through MMS